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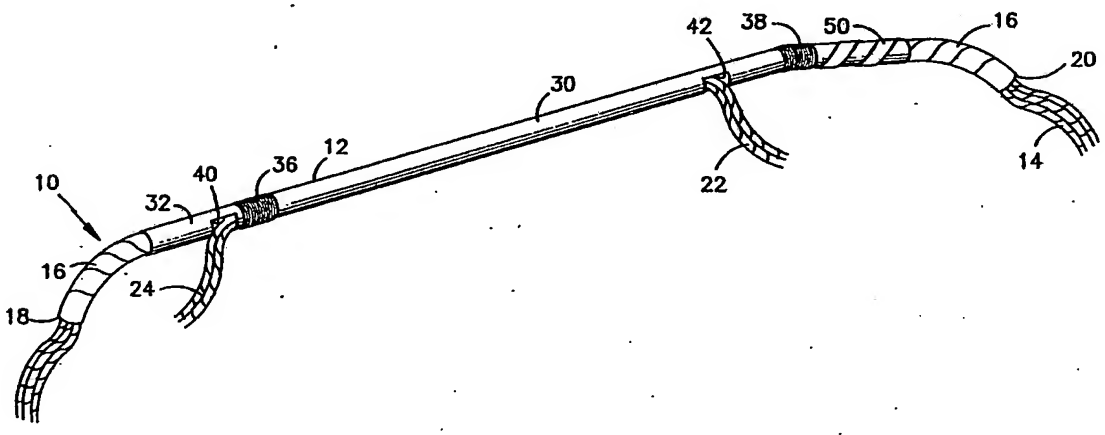

(57) Abstract

An automobile wire harness assembly which includes a unitary extruded support conduit (12) of resilient material having preformed flexible sections (36, 38), take-out apertures (40, 42) and mounting apertures (44) positioned to correspond to the respective wire harness (10) and routing path in the vehicle.

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Wiring Harness Conduit

Background of the Invention

This invention relates to electrical wiring conduit and more particularly to wiring conduit for automobile wire harnesses.

In automobiles, the various electrical components of the vehicle are electrically connected to the battery by electrical leads or wires grouped or bundled together to form what is commonly termed a wire harness. In order to protect the wire harness from cuts and chafing which might occur with contact with sharp edges, sheet metal parts, etc., the harness is housed in a wiring conduit.

One common type of harness conduit is a plastic corrugated tube which is axially slit throughout its length. This tube is corrugated along the longitudinal axis so as to be very flexible. The corrugated tube is versatile in that it can be readily bent for installation and the axial slit allows electrical leads to be routed out from the harness at any location along the tube. Such tubes are disclosed in Nestor, U.S. 4,384,167 and Ghirardi et al., U.S. 3,711,633. Corrugated tubes are not satisfactory however where the harness conduit must actually support the wiring harness.

In applications where the harness conduit must support the wire harness, a C-channel conduit is commonly utilized. This type of conduit basically comprises two elongated C-section pieces which are mated together about the wire harness so as to form a conduit and are secured by wrapping tape or the like. The C-channel sections are rigid plastic members that necessitate a segmented

conduit configuration when some flexing is required in routing the wire harness in the automobile body. To obtain flexing capability, the rigid tube sections (formed from the C-channel sections) are butted end to end with each other and secured with tape so as to function as a joint and provide a degree of flexing, i.e., the annular "break" between the tube sections forms a flexible joint. Thus, multiple sections of C-channel conduit must be joined together if flexing is required at several points in routing the wire within the automobile body. Furthermore, routing out groups of wires (commonly referred to as "take-outs") from the wire harness also requires additional separate segments of C-channel conduit since the take-outs are routed through breaks in the C-channel conduit. For example, a wire harness requiring two take-outs and two flexible points may require five separate segments of conduit arranged end to end to form the harness conduit.

Another type of rigid automobile wiring harness conduit is trough or scroll conduit. Trough conduit is an extruded tubular member which is slit longitudinally end-to-end so that one longitudinal edge overlaps the opposing longitudinal edge to compress or adjust about the wire harness. Similar to the C-channel conduit, trough conduit is utilized in separate sections butted end-to-end to obtain flexing and for routing out wire groups from the wire harness.

The assembly of such conduits to the wire harness is labor intensive where a plurality of separate conduit sections are necessary for the desired flexing and/or to rout out groups of wires from the wire harness. Generally, each segment of conduit must be manually positioned and secured to the wire harness.

Furthermore, the multiple segment construction of such conduit assemblies produces variations in the relative positioning of the flexible joints, the wire take-outs and the mounting connectors. Such variance can adversely affect installation of the wire harness assembly into the automobile body. For example, in a wire harness, the mounting connectors are positioned so as to align with the mounting recesses in the vehicle body when the wire harness is properly positioned within the vehicle body. Similarly, the relative location of the take-outs and the flexible joints must correspond with the structure of the vehicle body for a proper installation. Consequently, variation in relative positioning can increase installation time and adversely affect quality.

Summary of the Invention

It is an object of the present invention provide a new and improved wire harness conduit.

Another object of the invention is to provide a unitary harness conduit with preformed flexible points, take-out apertures and mounting apertures positioned to correspond to the respective wire harness.

Another object of the invention to provide a harness conduit which has predetermined flexible points and is able to support a wire harness.

A further object of the invention is to provide such a conduit which minimizes cross-sectional size of the wire harness assembly.

A further object of the invention is to provide such a conduit which is economical to manufacture and convenient and efficient to assemble to the wire harness.

Another object of the invention is to provide a wire harness assembly which facilitates installation into the automobile body by precise positioning of flexible points, wire harness take-outs, and mounting connectors.

Accordingly, it has been found that the above-noted disadvantages in the prior art are overcome and the foregoing objects are attained in an automobile wiring harness conduit having a unitary tubular wall member of resilient material forming a longitudinal wire passage for housing the wire harness. The tubular wall member has first and second rigid sections for supporting the wire harness and a third interconnecting section. The third section is configured so as to be flexible to permit non-aligned relative positioning of the first and second section. In a preferred embodiment, the third flexible section is corrugated along its longitudinal axis so as to be flexible in directions transverse to the longitudinal axis. The tubular member has an end-to-end longitudinal slit defining opposed longitudinal edges and is configured so that one longitudinal edge is biased to overlap the other longitudinal edge and fit snugly about the wire harness. The rigid sections of the tubular wall member have take-out apertures for routing wires from a wire harness and mounting apertures to receive connectors for mounting the conduit to an automobile body. The flexible section, the take-out apertures and the mounting apertures are preformed and positioned to accurately correspond to the wire harness and predetermined routing pathway in the vehicle body.

Brief Description of the Drawings

Figure 1 is a perspective view of an automobile wiring harness assembly including the harness conduit of the present invention.

Figure 2 is an enlarged perspective view partly broken away of the conduit of the present invention.

Figure 3 is a sectional view seen on line 3-3 of Figure 2.

Figure 4 is a perspective view of the wiring conduit of Figure 1 rotated 180°.

Description of the Preferred Embodiment

Although specific forms of the present invention have been selected for illustration in the drawings, and the following description is drawn in specific terms for the purpose of describing these forms of the invention, the description is not intended to limit the scope of the invention which is defined in the appended claims.

Referring to Figure 1, an automobile wiring harness assembly is shown generally comprising a conventional automobile wiring harness 10 and a wiring conduit 12 mounted thereto. The wiring harness 10 generally comprises a plurality of electrical leads 14 bundled together by tape 16 or the like to form an elongated relatively compact bundle of wires extending generally longitudinally between ends 18,20. For purposes of explanation, individual groups of wires 22,24 (commonly referred to as take-outs) are routed from the wire harness between the ends 18,20 for connection to respective electrical circuits in the automobile.

Generally the wire harnesses include a plurality of varied electrical connectors and circuit components (not shown). A plurality of mounting connectors (not shown) are secured to the wire harness by tape or the like. A common type of mounting connector is a push-on plastic connector referred to as a Christmas tree connector. The mounting connectors are relatively positioned on the wire harness to correspond to the positioning of the preformed mounting recesses in the vehicle body. Further detail of wiring harness 10 is not required for purposes of description of the present invention.

Referring to Figure 4, the wiring conduit 12 of the present invention is a unitary tubular wall member of resilient plastic material forming a longitudinal wire passageway between opposite ends 26,28. For purposes of description, the conduit 12 has a rigid elongated central section 30 connected to opposite rigid end sections 32,34 by flexible sections 36,38, respectively. The flexible section 36 is corrugated along its longitudinal axis so as to provide a degree of flexibility in directions transverse to the longitudinal axis so as to allow the sections 30,32 to be moved into non-aligned positions. Other known flexible configurations may be utilized for section 36 depending upon the degree of flexibility required for the particular routing path of the wiring harness. The flexible section 38 is identical to section 36.

The end section 32 has a take-out aperture or notch 40 for routing the wire group 24 out from the wire harness 10. Similarly, the central section 30 has a take-out aperture 42 to take out the wire group 22 from the wiring harness 10. The take-out apertures 40,42 are precisely positioned so that the respective take-out

leads 24,22 are accurately located for routing along a predetermined path in the vehicle body upon installation. The rigid sections 30,32,34 also have mounting apertures 44 to receive the mounting connectors (not shown) of the wire harness 10 for securing the conduit 12 to the automobile body. The mounting apertures 44 are accurately positioned to correspond to the spacing of the mounting recesses in the automobile body.

The conduit 12 is a unitary extruded member preferably constructed of polypropolyene. The mounting apertures 44 and the take-out apertures 40,42 are preformed in the extruded conduit by punching or the like. The conduit 12 has an axial slit 45 end-to-end so as to define overlapping edge sections 46,48 as seen in Figure 3. The conduit 12 is configured to bias the edge sections 46,48 to overlap so as to tend to compress or adjust about the wire harness 10. In this manner, the conduit 12 is self-adjusting to the diameter of the wire harness 10 to minimize the diameter of the wiring harness assembly for ease of routing and conservation of space when installed in the automobile body. Tape 50 is wrapped around the exterior of the conduit 12 in a candy-stripe pattern to maintain the conduit 12 in a compressed configuration about the wire harness 10.

In the illustrated embodiment, the conduit 12 is dimensioned and configured for a particular wiring harness and routing path in the respective automobile body. For example, in the illustrated embodiment, the overall length of conduit 12 is 1183mm and sections 32,34 are approximately 189mm, sections 36,38 are 50mm and section 30 is approximately 700mm. The relative length of the corrugated flexible sections 36,38 provide a sufficient degree of flexibility for the respective

routing path of the wire harness 10. The length of the flexible sections may be varied to set the degree of flexibility and relative orientation of the rigid sections as required for a particular application.

While the illustrated embodiment includes three rigid sections 30,32,34 interconnected by two flexible sections 36,38, it is to be understood that the relative number of rigid and flexible sections and the relative lengths thereof are dictated by the wire harness routing path in the automobile and the configuration of the wire harness itself.

In assembly, the wire harness 10 is inserted into the conduit 12 through the longitudinal slit 45 with the take-out wires 22,24 being routed through the take-out apertures 42,40, respectively. The apertures 44 are aligned with the connectors (not shown) on the wire harness so as to extend therethrough. The conduit 12 is secured to the wire harness 10 by tape wrapping 50 which extends the length of the conduit 12 in a candy-stripe pattern (only a portion of which is shown in Fig. 1). The wiring harness assembly is then ready for installation in the automobile body.

Installation of the wire harness assembly in the automobile body is facilitated by accurate positioning of the flexible sections 36,38, the mounting slots 44 and the take-out wire groups 22,24. Upon mounting to the automobile body, the rigid sections 30,32,34 support the wire harness in position in the automobile body yet allow bending and flexibility for the sections 32,34.

Accordingly, a wiring harness conduit has been described which provides support and protection to a wire harness while allowing flexible positioning at predetermined points. The unitary conduit is matched to

the wire harness with preformed flexible points, take-out apertures and mounting apertures positioned to correspond to the respective wire harness and routing path in the automobile. The conduit is economical to manufacture and convenient and efficient to assemble and install. Installation of the wire harness assembly is facilitated by precise positioning of flexible points, wire harness take-outs, and mounting connectors. Furthermore, the cross-sectional size of the wire harness assembly is minimized to facilitate routing within the automobile body. As can be seen, the present invention accomplishes all of its stated objectives.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

Claims

What is claimed is:

1. An automobile wire harness assembly comprising:
an elongated automobile wiring harness adapted to extend generally axially between first and second points when mounted in an automobile body with a plurality of groups of electrical wires to be routed out from said harness, and
a wiring conduit comprising,
a unitary tubular wall member of resilient material forming a wire passageway housing said wire harness between first and second points,
said tubular wall member having first and second rigid sections and a third section connecting said first section to said second section, and
said third section being configured so as to be flexible to permit non-aligned relative positioning of said first and second sections in routing said wire harness within an automobile body.

2. The assembly of claim 1 wherein said wall member has an end-to-end longitudinal slit and said wall member is compressed snugly about said wire harness.

3. The assembly of claim 2 wherein said third section is corrugated along its longitudinal axis so as to be flexible in directions transverse to said longitudinal axis.

4. The assembly of claim 3 wherein said first and second sections are rigid so as to support said wire harness when said wiring conduit is secured to an automobile body.

5. The assembly of claim 3 wherein said first section has an aperture and a first group of wires from said wire harness is routed outwardly through said aperture.

6. The assembly of claim 5 wherein said first and second sections have mounting apertures to receive connectors for mounting the conduit to an automobile body.

7. The assembly of claim 2 wherein said wiring conduit is an extruded plastic member.

8. The assembly of claim 1 wherein said first and second sections are rigid so as to support said wire harness when said wiring conduit is secured to an automobile body.

9. The assembly of claim 1 wherein said first section has an aperture and a first group of wires from said wire harness is routed outwardly through said aperture.

10. The assembly of claim 1 wherein said third section is corrugated along its longitudinal axis so as to be flexible in directions transverse to said longitudinal axis.

11. The assembly of claim 1 wherein:
said wall member comprises a fourth rigid section and a fifth section connecting said fourth section to said first section,
said fifth section being configured so as to be flexible to permit non-aligned relative positioning of said first and fourth sections.

12. The assembly of claim 11 wherein:
said first section has a first aperture and a first group of wires from said wire harness is routed outwardly therethrough,
said second section has a second aperture and a second group of wires from said wire harness is routed outwardly therethrough,
said first, second and fourth sections have mounting apertures, and
said wire harness has a plurality of connectors extending respectively through said mounting apertures.

13. Automobile wiring harness conduit comprising:
a unitary tubular wall member of resilient material forming a longitudinal wire passageway for housing a wire harness between first and second points,
said tubular wall member having first and second rigid sections and a third section connecting said first section to said second section, and
said third section being configured so as to be flexible to permit non-aligned relative positioning of said first and second sections.

14. The device of claim 13 wherein said wall member has an end-to-end longitudinal slit defining first and second opposed longitudinal edges, said wall member being configured so that said first longitudinal edge is biased to overlap said second longitudinal edge.

15. The device of claim 14 wherein said third section is corrugated along its longitudinal axis so as to be flexible in directions transverse to said longitudinal axis.

16. The device of claim 15 wherein said first and second sections are rigid so as to support a wire harness therein when said sections are secured to an automobile body.

17. The device of claim 14 wherein said first section has a take-out aperture for routing wires out from a wire harness within said wall member.

18. The device of claim 17 wherein said first and second sections have mounting apertures to receive connectors for mounting the conduit to an automobile body.

19. The device of claim 14 wherein said wall member is an extruded plastic tubular member.

20. The device of claim 13 wherein said third section is corrugated along its longitudinal axis so as to be flexible in directions transverse to said longitudinal axis.

21. The device of claim 13 wherein said first and second sections have mounting apertures to receive connectors for mounting the conduit to an automobile body.

22. The device of claim 13 wherein said first and second sections are rigid so as to support a wire harness therein when said sections are secured to an automobile body.

23. The device of claim 13 wherein:
said wall member comprises a fourth rigid section and a fifth section connecting said fourth section to said first section,
said fifth section being configured so as to be flexible to permit non-aligned relative positioning of said first and fourth sections.

24. An automobile wire harness assembly comprising:
an elongated automobile wiring harness adapted to
extend generally axially between
first and second points when mounted
in an automobile body,
said harness having a group of electrical take-
out leads routed from the wire harness at
a predetermined position between the first
and second points and a predetermined
number of mounting connectors positioned
along said wire harness between said first
and second points and adapted for mounting
within mounting recesses in the automobile
body, and
a wiring conduit comprising,
a unitary tubular wall member of resilient
material forming a wire passageway housing
said wire harness between first and second
points,
said tubular wall member having first and
second rigid sections and a
third section connecting said first
section to said second section, and
said third section being configured so as to be
flexible to permit non-aligned relative
positioning of said first and second
sections in routing said wire harness
within an automobile body,
said tubular wall member having a
predetermined number of preformed mounting
apertures spaced and positioned in
correspondence with said predetermined
number of mounting connectors to

number of mounting connectors to respectively receive said mounting connectors therethrough, and

said tubular wall member having a preformed take-out aperture disposed adjacent said predetermined position so that said group of take-out leads extends therethrough.

25. The assembly of claim 24 wherein:

said wire harness has a predetermined number of groups of electrical take-out leads, said groups being positioned along said wire harness between said first and second points for routing from said wire harness and

said tubular wall member has a predetermined number of preformed take-out apertures spaced and positioned in correspondence with said predetermined number of groups of electrical take-out leads to respectively receive said groups therethrough.

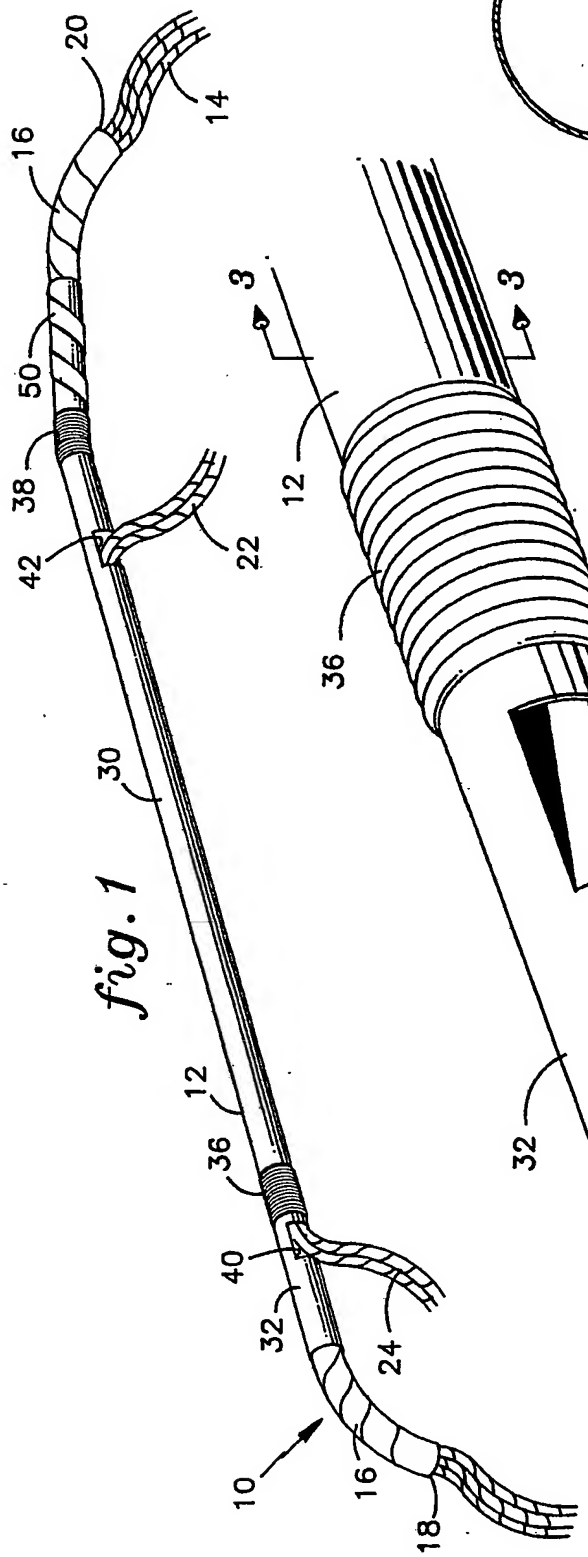

fig. 1

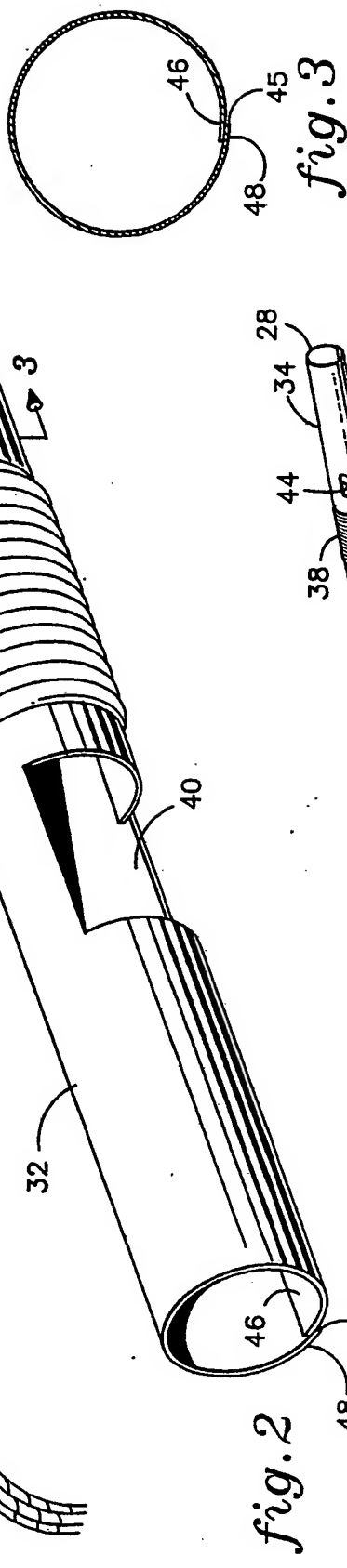

fig. 2

fig. 3

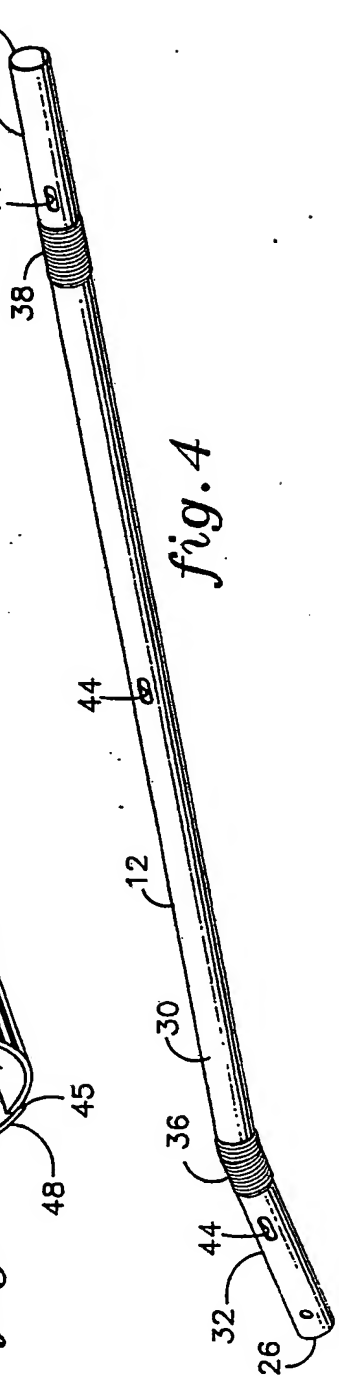

fig. 4

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02052

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H02G 3/04; F16L 11/14
US CL :174/71R,72A,13B,68.1,68.3; 138/120,121,155
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 1,035,931 (WOODHOUSE) 20 August 1912, See fig. 4.	1-25
Y	US, A, 3,716,733 (KEITH ET AL.) 13 February 1973, See figs. 1-3 and Abstract.	1-4,7,8,10, 13-16,19,20, 22,24,25
Y	US, A, 3,080,892 (PLUMMER) 12 March 1963, See figs. 2 and 5.	5,6,9,11,12, 17,18,21,23-25
Y	US, A, 4,918,261 (TAKAHASHI ET AL.) 17 April 1990, See Abstract.	5,6,9,11,12, 17,18,21,23-25

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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Date of the actual completion of the international search
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02052

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Chicago Metal Hose Corporation, 23 December 1940, Rex-Flex, pp. 1-7 "Stainless Steel Flexible Tubing for Aircraft Applications".	11,12,23-25